

```

00010          NAM      ASTMON
00020          * ASTRAL 2000 MONITOR / DEBUG WITH VDM
00030          * REV. 7.2                      5 MAY 1977
00040          *
00050          *
00080          OPT      0
00090          OPT      S
00100          E800    ROMORG EQU    $E800
00110          E000    RAMORG EQU    $E000
00120          FD10    PIAVD  EQU    $FD10
00130          E400    PIASIO EQU    $E400    SERIAL I/O
00140          *
00150          *
00400          * COMMANDS:
00401          *          R          REGISTER TYPE
00402          *          (/)L        LOAD
00403          *          P (LOC,LOC)  PUNCH
00404          *          A LOC,VAL VAL...ALTER
00405          *          /A REG        ALTER REG C, B, A, X, P OR
00406          *          //A LOC,ASCII STRING
00407          *          (/)T LOC(,COUNT) TYPE
00408          *          G LOC          GOTO
00409          *          W LOC          INSERT BLOCK
00410          *          I LOC,VAL VAL...INSERT
00411          *          Q              QUERY ALL BREAKPOINTS
00412          *          B LOC(,LOC...) SET BREAKPOINTS
00413          *          D (LOC,LOC...) DELETE BREAKPOINTS
00414          *          N (LOC,LOC...) NEXT BREAKPOINT
00415          *          H              HOLD BREAKPOINT AND GO
00416          *          (/)SPACE BAR  TYPE NEXT N LOCATIONS
00417          *          % COUNT       DEFAULT TYPE COUNT
00418          *          %              INITIALIZE INTERCEPTS
00419          *
00552          *
00560          * NOTES:
00561          *          RXX IS REL ADDRESS REQUEST
00562          *          I WITHIN INSERT REFERS TO INSTR (AUTO SIZE
00563          *          J WITHIN INSERT REFERS TO JUMP BACK
00564          *          JN MEANS N BYTES AFTER INSERT POINT
00565          *          NO OVERFLOW CHECK ON BREAKPOINTS
00566          *          MAY NOT SET A BREAKPOINT IF ALREADY A 3F
00567          *          (BUT NO ERROR GIVEN)
00568          *          RESETTNG NON-EXISTANT BREAKPOINT GIVES ?
00569          *          ALL COMMANDS MUST END WITH 'CR'
00570          *          NEXT RESETS CURRENT BREAKPOINT, OPTIONALLS
00571          *          NEW ONES AND RESETS OLD BREAK LOCATOR
00572          *          RESET BREAKPOINTS WILL RESET ALL IF NONE D
00573          *          ASCII TYPE WILL ZERO PARITY BIT AND WILL T
00574          *          ? FOR 00-1F AND 7B-7F
00575          *          /L WILL ECHO WHERE L WILL NOT ECHO
00576          *          P WILL PUNCH 'S9'
00580          *
00590          *
00591          * VDM:

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00592      *      16 LINES, 80 CHAR/LINE
00593      *      CR
00594      *      LF
00595      *      BS
00596      *      CLEAR (CONTROL L) OC
00597      *      HOME (CONTROL N) OE
00598      *
00599      *
00600 E000      ORG      RAMORG
00610 E000 0002  AMINT  RMB      2      ADDRESS MASKABLE INTERRUPT
00620 E002 0002  ASINT  RMB      2      ADDRESS SOFTWARE INTERRUPT
00630 E004 0002  ANMINT RMB      2      ADDRESS NON MASKABLE INTERRUPT
00640 E006 0001      RMB      1      CLOCK HOURS
00650 E007 0001      RMB      1      CLOCK MINUTES
00660 E008 0001      RMB      1      CLOCK SECONDS
00670 E010      ORG      RAMORG+$10
00680 E010 0002  VDCUR  RMB      2      VD CURSOR (0 TO 1919)
00690 E012 0002  AVDBUF RMB      2      ADDRESS OF VD BUFFER
00700 E014 0002  ATOPM  RMB      2      ADDRESS OF TOP MEMORY (EXCL.
00710 E016 0002  AII    RMB      2      ADDRESS OF INPUT INTERCEPT
00720 E018 0002  ADI    RMB      2      ADDRESS OF DEBUG COMMAND ANTE
00730 E01A 0002  AOI    RMB      2      ADDRESS OF OUTPUT INTERRUPT
00740 E01C 0001  CHAR   RMB      1      INPUT CHAR
00750 E01D 0001  CHARUC RMB      1      INPUT CHAR UPPER CASE AND NO
00760 E01E 0002  VAL    RMB      2
00770 E020 0002  TYPLOC RMB      2
00780 E022 0001  TYPCNT RMB      1
00790 E023 0002  ALTLOC RMB      2
00800 E025 0002  INBLK  RMB      2
00810 E027 0002  INLOC  RMB      2
00820 E029 0002  BRKPTR RMB      2
00830 E02B 0002  BRKSAV RMB      2
00840 E02D 0001  COLCNT RMB      1
00850 E02E 0001  RELMOD RMB      1
00860 E02F 0001  INST0  RMB      1
00870 E030 0001  INST1  RMB      1
00880 E031 0001  INST2  RMB      1
00890 E032 0003      RMB      3      FOR JUMP BACK
00900 E035 0001  INSIZE RMB      1
00910 E036 0002  TEMP99 RMB      2
00920 E038 0002  VDTMP  RMB      2
00930 E03A 0001  DFLTCC RMB      1      DEFAULT COLUMN TYPE COUNT
00940 E03B 0002  XSUMV  RMB      2      CHECKSUM VALUE
00950 E03D 0002  XSUMB  RMB      2      CHECKSUM BEGIN ADDR
00960 E03F 0002  XSUME  RMB      2      CHECKSUM END ADDR+1
00970      *
00980 E041 0002  IOV    RMB      2      IO INTERRUPT POINTER
00990 E043 0002  BEGA   RMB      2      BEGINNING ADDR PRINT/PUNCH
01000 E045 0002  ENDA   RMB      2      ENDING ADDR PRINT/PUNCH
01010 E047 0002  NIO    RMB      2      NMI INTERRUPT POINTER
01020 E049 0001  SP     RMB      1      S-HIGH
01030 E04A 0001      RMB      1      S-LOW
01040 E04B 0001  CKSM   RMB      1      CHECKSUM
01050 E04C 0001  BYTECT RMB      1      BYTE COUNT

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01060	E04D	0001	XHI	RMB	1	XREG HIGH
01070	E04E	0001	XLOW	RMB	1	XREG LOW
01080	E04F	0001	TEMP	RMB	1	CHAR COUNT (INADD)
01090	E050	0002	TW	RMB	2	TEMP/
01100	E052	0001	MCONT	RMB	1	TEMP
01110	E053	0002	XTEMP1	RMB	2	
01120	E055	0001	SLMODE	RMB	1	NZ=/MODE
01130	E056	0002	ZLOC1	RMB	2	
01140	E058	0002	ZLOC2	RMB	2	
01150	E05A	0002	ZVAL	RMB	2	
01160	E05C	0002	XTEMP	RMB	2	X-REG TEMP STORAGE
01170	E05E	000A	PWRTST	RMB	10	
01180	E068		PWREND	EQU	*	
01190	E068	0050		RMB	80	
01200	E0B8	0001	STACK	RMB	1	STACK POINTER
01210	E0B9	0007		RMB	7	
01220	E0C0	0002	STKUF	RMB	2	STACK UNDERFLOW
01230			*			
01240	E0C2	003C	BRKTBL	RMB	60	ALLOWS 20 BREAKPOINTS
01250			*			
01260			*			
01270			*			

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01300      *
01390 E800      ORG      ROMORG
01400      *
01410 E800 FE E000 INTINT LDX      AMINT
01420 E803 6E 00      JMP      X
01430 E805 FE E002 INTSFT LDX      ASINT
01440 E808 6E 00      JMP      X
01450 E80A FE E004 INTNM  LDX      ANMINT
01460 E80D 6E 00      JMP      X
01465      *
01470      * 'MAIN CONTROL'
01480      *
01490      * ENTER POWER ON SEQUENCE
01500      E80F      START EQU      *
01510      E80F      RSTINT EQU     *
01520      *
01530 E80F 8E E0B8      LDS      #STACK
01540 E812 BF E049      STS      SP      INZ TARGET'S STACK PNTR
01550      * INZ PIA
01560 E815 CE E400      LDX      #PIAD      (X) POINTER TO DEVICE PIA
01570 E818 6C 00      INC      X      SET DATA DIR PIAD
01580 E81A 86 07      LDA A      #7
01590 E81C A7 01      STA A      1,X      INIT CON PIAS
01600 E81E 6C 00      INC      X      MARK COM LINE
01610 E820 A7 02      STA A      2,X      SET DATA DIR PIADB
01620 E822 7F FD13     CLR      PIAVD+3   CTR B
01630 E825 7F FD12     CLR      PIAVD+2   OUTPUT B
01640      * TEST IF POWER OR RESET BUTTON
01650 E828 CE E05E     LDX      #PWRTST
01660 E82B 4F          CLR A
01670 E82C AA 00      MC3      ORA A      X
01680 E82E 6F 00      CLR      X
01690 E830 08          INX
01700 E831 8C E068     CPX      #PWREND
01710 E834 26 F6      BNE      MC3
01720 E836 4D          TST A
01730 E837 27 69      BEQ      CONTRL
01740      *
01750      * CLEAR MONITOR RAM
01760      *
01770 E839 CE E000     LDX      #RAMORG
01780 E83C 6F 00      MC2      CLR      X
01790 E83E 08          INX
01800 E83F 8C E100     CPX      #RAMORG+256
01810 E842 26 F8      BNE      MC2
01820      *
01830      *
01840 E844 CE FFFE     LDX      #FFFFE      ZERO OUT MEMORY AND FIND TOP
01850 E847 08          MC1      INX
01860 E848 6F 01      CLR      1,X
01870 E84A 6D 01      TST      1,X
01880 E84C 27 F9      BEQ      MC1
01890 E84E FF E014     STX      ATOPM
01900 E851 BF E049     STS      SP

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01910      *
01920      * INITIALIZE TO NO BREAKS IN TABLE
01930      *
01940 E854 CE E0C2      LDX      #BRKTBL
01950 E857 FF E029      STX      BRKPTR
01960      *
01970      *
01980      * INITIALIZE INTERCEPTS
01990      *
02000 E85A CE EF37 ININ  LDX      #SFTINT
02010 E85D FF E004      STX      ANMINT
02020 E860 FF E000      STX      AMINT
02030 E863 FF E002      STX      ASINT
02040 E866 CE EFA8      LDX      #OINCPT
02050 E869 FF E01A      STX      AOI
02060 E86C CE EEBA      LDX      #IINCEP
02070 E86F FF E016      STX      AII      INPUT INTERCEPT
02080 E872 CE E8CE      LDX      #DINCPT
02090 E875 FF E018      STX      ADI      DEBUG COMMAND INTERCEPT
02010 E878 86 08      LDA A      #8
02110 E87A B7 E03A      STA A      DFLTCC      DEFAULT COLUMN TYPE COUNT
02120      *
02130      * TEST IF VDM IN SYSTEM
02135      *
02140 E87D 7D FD12      TST      PIAVD+2
02150 E880 26 0F      BNE      MCNOVD
02160      *
02170      * YES - INITIALIZE VDM
02180 E882 B6 E014      LDA A      ATOPM
02190 E885 80 08      SUB A      #8
02200 E887 B7 E014      STA A      ATOPM
02210 E88A 4C      INC A
02220 E88B B7 E012      STA A      AVDBUF
02230 E88E BD EDC6      JSR      VDCLR
02240      E891      MCNOVD EQU      *
02250      *
02260      * POWER ON MESSAGE
02270      *
02280 E891 86 34      LDA A      ##34
02290 E893 B7 E403      STA A      PIASB
02300 E896 B7 E402      STA A      PIADB
02310 E899 BD EA13      JSR      CRLF
02320 E89C CE EFE5      LDX      #MPWON
02330 E89F BD EF01      JSR      PDATA1

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02350          * POWER ON
02360 E8A2 86 34  CONTRL LDA A  #34
02370 E8A4 B7 E403      STA A  PIASB   SET CONTROL PIASB TURN READER
02380 E8A7 B7 E402      STA A  PIADB   SET TIMER INTERVAL
02390 E8AA 86 06        LDA A  #6
02400 E8AC B7 FD13      STA A  PIAVD+3 CTR B
02410 E8AF 8E E0B8      LDS      #STACK SET CONTRL STACK POINTER
02420 E8B2 CE E80F      LDX      #RSTINT
02430 E8B5 FF E0C0      STX      STKUF
02440 E8B8 CE ED36      LDX      #MCLOFF
02450 E8BB BD EF01      JSR      PDATA1  PRINT DATA STRING
02460 E8BE 7F E055      CLR      SLMODE
02470 E8C1 BD E9A3 PORNC JSR      INCH
02480 E8C4 16          TAB
02490 E8C5 81 25          CMP A  #'%
02450 E8C7 27 91          BEQ      ININ   INITIALIZE INTERCEPTS
02510 E8C9 FE E018      LDX      ADI
02520 E8CC 6E 00          JMP      X
02530          E8CE      DINCPT EQU      *
02540 E8CE CE E8E5      LDX      #POTBL
02550 E8D1 E1 00      PONXT CMP B  X
02560 E8D3 27 0C      BEQ      POEQ
02570 E8D5 6D 00      TST      0,X
02580 E8D7 2B 05      BMI      POCE
02590 E8D9 08          INX
02600 E8DA 08          INX
02610 E8DB 08          INX
02620 E8DC 20 F3      BRA      PONXT
02630          *
02640 E8DE 7E E962 POCE  JMP      COMERR
02650          *
02660 E8E1 EE 01      POEQ  LDX      1,X
02670 E8E3 6E 00      JMP      0,X
02680          *
02690 E8E5 4C      POTBL FCB      'L
02700 E8E6 E91B      FDB      LOAD
02710 E8E8 3B      FCB      'I
02720 E8E9 EA2F      FDB      SETCC
02730 E8EB 41      FCB      'A
02740 E8EC EA3B      FDB      ALTCOM
02750 E8EE 54      FCB      'T
02760 E8EF E9B3      FDB      TYPCOM
02770 E8F1 52      FCB      'R
02780 E8F2 EF4B      FDB      PRINT
02790 E8F4 50      FCB      'P
02800 E8F5 ECA4      FDB      PUNCH
02810 E8F7 47      FCB      'G
02820 E8F8 EA90      FDB      GOCOM
02830 E8FA 57      FCB      'W
02840 E8FB EAAD      FDB      WCOM
02850 E8FD 49      FCB      'I
02860 E8FE EAB6      FDB      INSERT
02870 E900 20      FCB      '
02880 E901 EA27      FDB      SPCBAR

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02890	E903	48	FCB	'H
02900	E904	EC56	FDB	HOLD
02910	E906	4E	FCB	'N
02920	E907	EBD1	FDB	BRKNXT
02930	E909	44	FCB	'D
02940	E90A	EBR4	FDB	BRKRST
02950	E90C	51	FCB	'Q
02960	E90D	EB8E	FDB	BRKQ
02970	E90F	42	FCB	'B
02980	E910	EBA7	FDB	BRKSET
02990	E912	2F	FCB	'/'
03000	E913	E916	FDB	POSL
03010	E915	FF	FCB	\$FF
03020	E916	7C E055	INC	SLMODE
03030	E919	20 A6	BRA	PORNC

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03050          * PAPER TAPE LOADER
03060      E91B  LOAD  EQU  *
03070      E91B  BD  EC9C      JSR  GETCR
03080      E91E  86  07          LDA  A  #7
03090      E920  7D  E055      TST  SLMODE
03100      E923  27  02          BEQ  PT1
03110      E925  86  37          LDA  A  #37
03120      E927  B7  E401 PT1   STA  A  PIAS      INIT TO ECHO IF / ELSE NO ECH
03130      E92A  86  3C          LDA  A  #3C      TURN READER RELAY ON
03140      E92C  B7  E403      STA  A  PIASB
03150      E92F  86  11          LDA  A  #11
03160      E931  8D  6D          BSR  OUTCH
03170      E933  LOAD3 EQU  *
03180      E933  BD  EF73      JSR  RPT
03190      E936  81  53          CMP  A  #'S      READ PT
03200      E938  26  F9          BNE  LOAD3      1ST CHAR NOT 'S
03110      E93A  BD  EF73      JSR  RPT      READ PT
03220      E93D  81  39          CMP  A  #'9
03230      E93F  27  2C          BEQ  LOAD21
03240      E941  81  31          CMP  A  #'1
03250      E943  26  EE          BNE  LOAD3      2ND CHAR NOT '1
03260      E945  7F  E04B      CLR  CKSM      ZERO CHECKSUM
03270      E948  8D  34          BSR  BYTE      READ BYTE
03280      E94A  80  02          SUB  A  #2
03290      E94C  B7  E04C      STA  A  BYTECT      BYTE COUNT
03300          * BUILD ADDRESS
03310      E94F  8D  1F          BSR  BADDR
03320          * STORE DATA
03330      E951  8D  2B      LOAD11 BSR  BYTE
03340      E953  7A  E04C      DEC  BYTECT
03350      E956  27  05          BEQ  LOAD15      ZERO BYTE COUNT
03360      E958  A7  00          STA  A  0,X      STORE DATA
03370      E95A  08          INX
03380      E95B  20  F4          BRA  LOAD11
03390      E95D  7C  E04B LOAD15 INC  CKSM
03400      E960  27  D1          BEQ  LOAD3
03410      E962  COMERR EQU  *
03430      E962  BD  EA13 LOAD19 JSR  CRLF
03440      E965  86  3F          LDA  A  #'?
03450      E967  8D  37          BSR  OUTCH
03460      E969  86  07          LDA  A  #7
03470      E96B  8D  33          BSR  OUTCH
03480      E96D  LOAD21 EQU  *
03490      E96D  7E  E8A2 C1    JMP  CONTRL
03500          * BUILD ADDRESS
03510      E970  8D  0C      BADDR BSR  BYTE      READ 2 FRAMES
03520      E972  B7  E04D      STA  A  XHI
03530      E975  8D  07          BSR  BYTE
03540      E977  B7  E04E      STA  A  XLOW
03550      E97A  FE  E04D      LDX  XHI      (X) ADDRESS WE BUILT
03560      E97D  39          RTS
03570          * INPUT BYTE (TWO FRAMES)
03580      E97E  BD  EFDA BYTE JSR  RPTHEX
03590      E981  48          ASL  A

```

Reader on
12 Punch
13 Reader off
14 Punch off

03600	E982	48		ASL	A	
03610	E983	48		ASL	A	
03620	E984	48		ASL	A	
03630	E985	16		TAB		
03640	E986	BD	EFDA	JSR		RPTHEX
03650	E989	1B		ABA		
03660	E98A	16		TAB		
03670	E98B	FB	E04B	ADD	B	CKSM
03680	E98E	F7	E04B	STA	B	CKSM
03690	E991	39		RTS		
03700	E992	44	OUTHL	LSR	A	OUT HEX LEFT BCD DIGIT
03710	E993	44		LSR	A	
03720	E994	44		LSR	A	
03730	E995	44		LSR	A	
03740	E996	84	OF	AND	A	OUT HEX RIGHT BCD DIGIT
03750	E998	8B	30	ADD	A	##F
03760	E99A	81	39	ADD	A	##30
03770	E99C	23	02	CMF	A	##39
03780	E99E	8B	07	BLS		OUTCH
03790				ADD	A	##7
03800	E9A0	7E	EF9B	* OUTPUT ONE CHAR		
03810				OUTCH	JMP	OUTEEE
03820	E9A3	BD	EF6B	*		
03830	E9A6	BD	EEE9	INCH	JSR	INEEE
03840	E9A9	17			JSR	CVUC
03850	E9AA	81	1B	TBA		
03860	E9AC	27	B4	CMF	A	##1B
02870	E9AE	81	00	BEQ		COMERR
03880	E9B0	27	B0	CMF	A	#0
03890	E9B2	39		BEQ		COMERR
				RTS		

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03910          * TYPE COMMAND
03920 E9B3 B6 E03A TYP COM LDA A DFLTCC
03930 E9B6 B7 E022 STA A TYP CNT
03940 E9B9 BD ED52 JSR GV16
03950 E9BC FF E020 STX TYP LOC
03960 E9BF 81 0D CMP A ##D
03970 E9C1 27 11 BEQ TC1
03980 E9C3 81 2C CMP A #' ,
03990 E9C5 26 49 BNE TCCE
04000 E9C7 BD ED52 JSR GV16
04010 E9CA 81 0D CMP A ##D
04020 E9CC 26 42 BNE TCCE
04030 E9CE B6 E01F LDA A VAL+1
04040 E9D1 B7 E022 STA A TYP CNT
04050 E9D4 B6 E03A TC1 LDA A DFLTCC
04060 E9D7 B7 E02D STA A COLCNT
04070 E9DA 8D 37 BSR CRLF
04080 E9DC CE E020 LDX #TYP LOC
04090 E9DF BD EF2E JSR OUT4HS
04100 E9E2 FE E020 LDX TYP LOC
04110 E9E5 7D E055 TC2 TST SLMODE
04130 E9E8 27 14 BEQ TC3
04140 E9EA A6 00 LDA A 0,X
04150 E9EC 84 7F AND A ##7F
04160 E9EE 81 1F CMP A ##1F
04170 E9F0 2E 02 BGT TC5
04180 E9F2 86 3F TC6 LDA A #' ? WAS NON PRINTING
04190 E9F4 81 7A TC5 CMP A ##7A
04200 E9F6 22 FA BHI TC6
04210 E9F8 BD EF9B JSR OUTEEE
04220 E9FB 08 INX
04230 E9FC 20 03 BRA TC4
04240 E9FE BD EF30 TC3 JSR OUT2HS
04250 EA01 FF E020 TC4 STX TYP LOC
04270 EA04 7A E022 DEC TYP CNT
04280 EA07 27 2F BEQ TCC
04290 EA09 7A E02D DEC COLCNT
04300 EA0C 26 D7 BNE TC2
04310 EA0E 20 C4 BRA TC1
04320          *
04340 EA10 7E E962 TCCE JMP COMERR
04350          *
04360          * OUTPUT CR LF
04370          *
04380 EA13 FF E053 CRLF STX XTEMP1
04390 EA16 CE EA20 LDX #TMCRLF
04400 EA19 BD EF01 JSR PDATA1
04410 EA1C FE E053 LDX XTEMP1
04420 EA1F 39 RTS
04430 EA20 0D TMCRLF FCB $D,$A,0,0,0,0,4
EA21 0A
EA22 00
EA23 00
EA24 00

```

EA25 00

EA26 04

```

04440      *
04450      *
04460      * SPACE BAR
04470      *
04480 EA27 B6 E03A SPCBAR LDA A DFLTCC
04490 EA2A B7 E022      STA A TYPCNT
04500 EA2D 20 A5      BRA TC1
04510      *
04520      * IN
04530      *
04540 EA2F BD ED52 SETCC JSR GV16
04550 EA32 F6 E01F      LDA B VAL+1
04560 EA35 F7 E03A      STA B DFLTCC
04570      EA38 C3      EQU *
04580 EA38 7E E8A2 TCC JMP CONTRL

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```

04600          * ALTER COMMAND
04610 EA3B B6 E055 ALTCOM LDA A  SLMODE
04620 EA3E 85 01          BIT A  #1
04630 EA40 26 1B          BNE    AC2
04640 EA42 BD ED52        JSR    GV16
04650 EA45 FF E023 AC1    STX    ALTLOC
04660 EA48 B6 E055        LDA A  SLMODE
04670 EA4B 85 02          BIT A  #2
04680 EA4D 26 35          BNE    AC3
04690 EA4F BD ED66        JSR    GV8
04700 EA52 27 E4          BEQ    ACC
04710 EA54 81 FF          CMP A  #$FF
04720 EA56 26 E0          BNE    ACC
04730 EA58 E7 00          STA B  0,X
04740 EA5A 08             INX
04750 EA5B 20 E8          BRA    AC1
04760          *
04770          EA38      ACC    EQU    C3
04780          *
04790 EA5D BD E9A3 AC2    JSR    INCH
04800 EA60 FE E049        LDX    SP
04810 EA63 08             INX
04820 EA64 81 43          CMP A  #'C
04830 EA66 27 DD          BEQ    AC1
04840 EA68 08             INX
04850 EA69 81 42          CMP A  #'B
04860 EA6B 27 D8          BEQ    AC1
04870 EA6D 08             INX
04880 EA6E 81 41          CMP A  #'A
04890 EA70 27 D3          BEQ    AC1
04900 EA72 08             INX
04910 EA73 81 58          CMP A  #'X
04920 EA75 27 CE          BEQ    AC1
04930 EA77 08             INX
04940 EA78 81 50          CMP A  #'P
04950 EA7A 27 C9          BEQ    AC1
04960 EA7C 08             INX
04970 EA7D 81 53          CMP A  #'S
04980 EA7F 27 C4          BEQ    AC1
05000 EA81 7E E962 CE10   JMP    COMERR
05010          *
05020 EA84 BD EF6B AC3    JSR    INEEE
05030 EA87 81 0D          CMP A  #$D
05040 EA89 27 AD          BEQ    ACC
05050 EA8B A7 00          STA A  0,X
05060 EA8D 08             INX
05070 EA8E 20 F4          BRA    AC3

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```
05090          * GO
05100 EA90 BD ED52 GOCOM JSR    GV16
05110 EA93 81 0D      CMP    A  ##D
05120 EA95 26 EA      BNE     CE10
00051 EA97 8C 0000    CPX     #0
05140 EA9A 27 0D      BEQ     G01
05150 EA9C FE E049    LDX     SP
05160 EA9F B6 E01E    LDA     A  VAL
05170 EAA2 A7 06      STA     A  6,X
05180 EAA4 B6 E01F    LDA     A  VAL+1
05190 EAA7 A7 07      STA     A  7,X
05200 EAA9 BE E049 G01 LDS     SP
05220 EAAC 3B        RTI
```

```

05240          * INSERT
05250          *
05260 EAAD BD ED52 WCOM JSR GV16
05280 EAB0 FF E025 I3 STX INBLK
05290 EAB3 7E E8A2 JMP CONTRL
05300          *
05310          *
05320 EAB6 BD ED52 INSERT JSR GV16
05340 EAB9 FF E027 STX INLOC
05350 EABC BD EB46 JSR GRPINS
05360 EABF FE E025 LDX INBLK
05370 EAC2 27 50 BEQ ICE
05380 EAC4 FF E023 I2 STX ALTLOC
05390 EAC7 BD ED66 JSR GV8
05400 EACA 27 10 BEQ I1
05410 EACC 81 01 CMP A #1
05420 EACE 27 22 BEQ I
05430 EAD0 81 02 CMP A #2
05440 EAD2 27 43 BEQ J
05450 EAD4 FE E023 LDX ALTLOC
05460 EAD7 E7 00 STA B 0,X
05470 EAD9 08 INX
05480 EADA 20 E8 BRA I2
05490          *
05500 EADC FE E027 I1 LDX INLOC
05510 EADF 86 7E LDA A #7E
05520 EAE1 A7 00 STA A 0,X
05530 EAE3 B6 E025 LDA A INBLK
05540 EAE6 A7 01 STA A 1,X
05550 EAE8 B6 E026 LDA A INBLK+1
05560 EAEB A7 02 STA A 2,X
05570 EAED FE E023 LDX ALTLOC
05580 EAF0 20 BE BRA I3
05590          *
05600          *
05610 EAF2 FE E023 I LDX ALTLOC
05620 EAF5 B6 E035 LDA A INSIZE
05630 EAF8 27 1A BEQ ICE
05640 EAFB F6 E02F LDA B INST0
05650 EAFD E7 00 STA B 0,X
05660 EAFF 08 INX
05670 EB00 4A DEC A
05680 EB01 27 C1 BEQ I2
05690 EB03 F6 E030 LDA B INST1
05700 EB06 E7 00 STA B 0,X
05710 EB08 08 INX
05720 EB09 4A DEC A
05730 EB0A 27 B8 BEQ I2
05740 EB0C F6 E031 LDA B INST2
05750 EB0F E7 00 STA B 0,X
05760 EB11 08 INX
05770 EB12 20 B0 BRA I2
05780          *
05790 EB14 7E E962 ICE JMP COMERR

```



```

05800      *
05810      *
05820 EB17 FE E023 J      LDX      ALTLOC
05830 EB1A 86 7E      LDA A      #$7E
05840 EB1C A7 00      STA A      0,X
05850 EB1E BD EF08      JSR      INHEX
05860 EB21 26 F1      BNE      ICE
05870 EB23 BB E028      ADD A      INLOC+1
05880 EB26 A7 02      STA A      2,X
05890 EB28 B6 E027      LDA A      INLOC
05900 EB2B 89 00      ADC A      #0
05910 EB2D A7 01      STA A      1,X
05920 EB2F 08      INX
05930 EB30 08      INX
05940 EB31 08      INX
05950 EB32 20 90      BRA      I2
05960      *
05970      *
05980 EB34 FF E036 ADDAX STX      TEMP99
05990 EB37 BB E037      ADD A      TEMP99+1
06000 EB3A 24 03      BCC      I15
06010 EB3C 7C E036      INC      TEMP99
06020 EB3F B7 E037 I15 STA A      TEMP99+1
06030 EB42 FE E036      LDX      TEMP99
06040 EB45 39      RTS
06050      *
06060      * GROUP INSTRUCTIONS
06070      *      SET INST0, INST1, INST2, INSIZE
06080      *      X POINTS TO INSTRUCTION ON ENTRY
06090      *
06100 EB46 A6 02 GRPINS LDA A      2,X
06110 EB48 B7 E031      STA A      INST2
06120 EB4B A6 01      LDA A      1,X
06230 EB4D B7 E030      STA A      INST1
06140 EB50 A6 00      LDA A      0,X
06150 EB52 B7 E02F      STA A      INST0
06160 EB55 81 CE      CMP A      #$CE
06170 EB57 27 2B      BEQ      ILDX
06180 EB59 81 8C      CMP A      #$8C
06190 EB5B 27 27      BEQ      ICPX
06200 EB5D 81 20      CMP A      #$20
06210 EB5F 27 27      BEQ      IBRA
06220 EB61 81 8D      CMP A      #$8D
06230 EB63 27 23      BEQ      IBSR
06235      * NOTE: LDS MISSING !
06240 EB65 44      LSR A
06250 EB66 44      LSR A
06260 EB67 44      LSR A
06270 EB68 44      LSR A
06280 EB69 CE EB74      LDX      #SIZTBL
06290 EB6C 8D C6      BSR      ADDAX
06300 EB6E A6 00      LDA A      0,X
06310 EB70 B7 E035 I10 STA A      INSIZE
06320 EB73 39      RTS

```

```
06330      *
06340 EB74 01  SIZTBL FCB      1,1,0,1,1,1,2,3,2,2,2,3,2,2,2,3
      EB75 01
      EB76 00
      EB77 01
      EB78 01
      EB79 01
      EB7A 02
      EB7B 03
      EB7C 02
      EB7D 02
      EB7E 02
      EB7F 03
      EB80 02
      EB81 02
      EB82 02
      EB83 03

06350      *
06360      EB84  ICPX  EQU      *
06370      EB84  ILDX  EQU      *
06380 EB84 86 03  LDA  A  #3
06390 EB86 20 E8  BRA      I10
06400      *
06410      EB88  IBRA  EQU      *
06420      EB88  IBSR  EQU      *
06430 EB88 4F    CLR  A
06440 EB89 20 E5  BRA      I10
```

```

06460          * BREAKPOINT
06470 EB8B 7E E8A2 B1      JMP      CONTRL
06480          *
06490          * QUERY (LIST) ACTIVE BREAKPOINTS
06500          *
06510 EB8E BD EC9C BRKQ     JSR      GETCR
06520 EB91 CE E0C2         LDX      #BRKTBL
06530 EB94 FF E029 B2      STX      BRKPTR
06540 EB97 BD EA13         JSR      CRLF
06550 EB9A EE 00           LDX      0,X
06560 EB9C 27 ED           BEQ      B1      FINISHED LIST
06570 EB9E FE E029         LDX      BRKPTR
06580 EBA1 BD EF2E         JSR      OUT4HS
06590 EBA4 08             INX
06600 EBA5 20 ED           BRA      B2
06610          *
06620          * BREAKPOINT SET
06630          *
06640          EBA7 BRKSET EQU      *
06650 EBA7 BD ED52 B3      JSR      GV16
06660 EBAA 36             PSH A
06670 EBAB 8D 3F          BSR      SBP
06680 EBAD 32             PUL A
06690 EBAE B1 0D          CMP A     #D
06700 EBB0 27 D9          BEQ      B1
06710 EBB2 20 F3          BRA      B3
06720          *
06730          * BREAKPOINT RESET
06740          *
06750          EBB4 BRKRST EQU      *
06760 EBB4 BD ED52 B4      JSR      GV16
06770 EBB7 8C 0000         CPX      #0
06780 EBBA 27 0A          BEQ      B7      RESET ALL
06790 EBBC 36             PSH A
06800 EBBD 8D 54          BSR      RBP
06810 EBBF 32             PUL A
06820 EBC0 B1 0D          CMP A     #D
06830 EBC2 27 C7          BEQ      B1
06840 EBC4 20 EE          BRA      B4
06850          * RESET ALL
06860 EBC6 CE E0C2 B7      LDX      #BRKTBL
06870 EBC9 EE 00           LDX      0,X
06880 EBCB 27 BE          BEQ      B1
06890 EBCD 8D 44          BSR      RBP
06900 EBCF 20 F5          BRA      B7
06910          *
06920          * BREAKPOINT NEXT
06930          *
06940          EBD1 BRKNXT EQU      *
06950 EBD1 BD ED52 B5      JSR      GV16
06960 EBD4 8C 0000         CPX      #0
06970 EBD7 27 08          BEQ      B6
06980 EBD9 36             PSH A
06990 EBDA 8D 10          BSR      SBP

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```

07000 EBDC 32          PUL A
07010 EBDD 81 0D      CMP A  ##D
07020 EBD F 26 F0     BNE  B5
07030 EBE1 FE E049 B6  LDX  SP
07040 EBE4 EE 06      LDX  6,X
07050 EBE6 8D 2B      BSR   RBP
07060 EBE8 BE E049     LDS  SP
07070 EBEB 3B         RTI
07080                *
07090                * SET BREAKPOINT (X)
07100                *
07110 EBEC FF E01E SBP  STX   VAL
07120 EBEF E6 00      LDA B  0,X
07130 EBF1 C1 3F      CMP B  ##3F
07140 EBF3 27 1D      BEQ   B11
07150 EBF5 86 3F      LDA A  ##3F
07160 EBF7 A7 00      STA A  0,X
07170 EBF9 FE E029     LDX   BRKPTR
07180 EBFC B6 E01E     LDA A  VAL
07190 EBFF A7 00      STA A  0,X
07200 EC01 B6 E01F     LDA A  VAL+1
07210 EC04 A7 01      STA A  1,X
07220 EC06 E7 02      STA B  2,X
07230 EC08 08         INX
07240 EC09 08         INX
07250 EC0A 08         INX
07260 EC0B FF E029     STX   BRKPTR
07270 EC0E 6F 00      CLR   0,X
07280 EC10 6F 01      CLR   1,X
07290 EC12 39         B11   RTS
07300                *
07310                * RESET BREAKPOINT (X)
07320                *
07330 EC13 FF E01E RBP  STX   VAL
07340 EC16 CE E0C2     LDX   #BRKTBL
07350 EC19 FF E02B B13  STX   BRKSAV
07360 EC1C A6 02      LDA A  2,X
07370 EC1E EE 00      LDX   0,X
07380 EC20 27 31      BEQ   B10
07390 EC22 BC E01E     CFX   VAL
07400 EC25 27 08      BEQ   B12      FOUND
07410 EC27 FE E02B     LDX   BRKSAV
07420 EC2A 08         INX
07430 EC2B 08         INX
07440 EC2C 08         INX
07450 EC2D 20 EA      BRA   B13
07460                *
07470 EC2F A7 00 B12   STA A  0,X      RESTORE ORIGINAL LOC
07480 EC31 FE E029     LDX   BRKPTR
07490 EC34 09         DEX
07500 EC35 09         DEX
07510 EC36 09         DEX
07520 EC37 FF E029     STX   BRKPTR
07530 EC3A A6 00      LDA A  0,X

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07540 EC3C E6 02      LDA B    2,X
07550 EC3E 37         PSH B
07560 EC3F E6 01      LDA B    1,X
07570 EC41 FE E02B     LDX      BRKSAV
07580 EC44 A7 00      STA A    0,X
07590 EC46 E7 01      STA B    1,X
07600 EC48 33         PUL B
07610 EC49 E7 02      STA B    2,X
07620 EC4B FE E029     LDX      BRKPTR
07630 EC4E 6F 00      CLR      0,X
07640 EC50 6F 01      CLR      1,X
07650 EC52 39         RTS
07660          EC53     B10     EQU      *
07670          EC53     CE2     EQU      *
07680 EC53 7E E962     BCE      JMP      COMERR
07690          *
07700          * HOLD BREAKPOINT AND GO
07710          *
07720 EC56 8D 44     HOLD     BSR      GETCR
07730 EC58 FE E049     LDX      SP
07740 EC5B EE 06     LDX      6,X
07750 EC5D 8D B4     BSR      RBP
07760 EC5F FE E01E     LDX      VAL
07770 EC62 BD EB46     JSR      GRPINS
07780 EC65 B6 E035     LDA A    INSIZE
07790 EC68 27 E9     BEQ      BCE
07800 EC6A CE E02F     LDX      #INSTO
07810 EC6D BD EB34     JSR      ADDAX
07820 EC70 86 7E     LDA A    ##7E
07830 EC72 A7 00     STA A    0,X
07840 EC74 B6 E01F     LDA A    VAL+1
07850 EC77 BB E035     ADD A    INSIZE
07860 EC7A A7 02     STA A    2,X
07870 EC7C B6 E01E     LDA A    VAL
07880 EC7F 89 00     ADC A    #0
07890 EC81 A7 01     STA A    1,X
07900 EC83 FE E049     LDX      SP
07910 EC86 B6 EC9A     LDA A    IO
07920 EC89 A7 06     STA A    6,X
07930 EC8B B6 EC9B     LDA A    IO+1
07940 EC8E A7 07     STA A    7,X
07950 EC90 FE E01E     LDX      VAL
07960 EC93 BD EBEC     JSR      SBP
07970 EC96 BE E049     LDS      SP
07980 EC99 3B         RTI
07990          *
08000 EC9A E02F     IO      FDB      INSTO
08010          *
08020          * GET CR ELSE ERROR
08030          *
08040 EC9C BD E9A3     GETCR   JSR      INCH
08050 EC9F 81 0D         CMP A    ##D
08060 ECA1 26 B0         BNE      B10
08070 ECA3 39         RTS

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```

08090          * PUNCH REOTINES
08100          EC53 PCE EQU CE2
08110          * PUNCH DUMP
08120          * PUNCH FROM BEGINNING ADDRESS (BEGA) THRU
08130          * ENDING ADDRESS (ENDA)
08140          *
08150          ECA4 PUNCH EQU *
08160 ECA4 BD ED52 JSR GV16
08170 ECA7 81 2C CMP A #'
08180 ECA9 27 0C BEQ P1
08190 ECAB 81 0D CMP A ##D
08200 ECAD 26 A4 BNE PCE
08210 ECAF CE ED49 LDX #PS9 PUNCH END RECORD
08220 ECB2 BD EF01 JSR PDATA1
08230 ECB5 20 60 BRA PCTRL
08240          *
08260 ECB7 FF E043 P1 STX BEGA
08270 ECBA BD ED52 JSR GV16
08280 ECBD FF E045 STX ENDA
08290 ECC0 81 0D CMP A ##D
08300 ECC2 26 8F BNE PCE
08310 ECC4 FE E043 LDX BEGA
08320 ECC7 FF E050 STX TW TEMP BEGINNING ADDRESS
08330 ECCA B6 E046 PUN11 LDA A ENDA+1
08340 ECCD B0 E051 SUB A TW+1
08350 ECD0 F6 E045 LDA B ENDA
08360 ECD3 F2 E050 SBC B TW
08370 ECD6 26 04 BNE PUN22
08380 ECD8 81 10 CMP A #16
08390 ECDA 25 02 BCS PUN23
08400 ECDC 86 0F PUN22 LDA A #15
08410 ECDE 8B 04 PUN23 ADD A #4
08420 ECE0 B7 E052 STA A MCONT FRAME COUNT THIS RECORD
08430 ECE3 80 03 SUB A #3
08440 ECE5 B7 E04F STA A TEMP BYTE COUNT THIS RECORD
08450          * PUNCH C/R, L/F, NULL, S, 1
08460 ECE8 CE ED40 LDX #PS1
08470 ECEB BD EF01 JSR PDATA1
08480 ECEE 5F CLR B ZERO CHECKSUM
08490          * PUNCH FRAME COUNT
08500 ECEF CE E052 LDX #MCONT
08510 ECF2 8D 26 BSR PUNT2 PUNCH 2 HEX CHAR
08520          * PUNCH ADDRESS
08530 ECF4 CE E050 LDX #TW
08540 ECF7 8D 21 BSR PUNT2
08550 ECF9 8D 1F BSR PUNT2
08560          * PUNCH DATA
08570 ECFB FE E050 LDX TW
08580 ECFE 8D 1A PUN32 BSR PUNT2 PUNCH QUE BYTE (2 FRAMES)
08590 ED00 7A E04F DEC TEMP DEC BYTE COUNT
08600 ED03 26 F9 BNE PUN32
08610 ED05 FF E050 STX TW
08620 ED08 53 COM B
08630 ED09 37 PSH B

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```

08640 ED0A 30          TSX
08650 ED0B 8D 0D      BSR      PUNT2      PUNCH CHECKSUM
08660 ED0D 33          PUL B
08670 ED0E FE E050     LDX      TW
08680 ED11 09          DEX
08690 ED12 BC E045     CPX      ENDA
08700 ED15 26 B3       BNE      PUN11
08710 ED17 7E E8A2     PCTRL    JMP      CONTRL
08720          * PUNCH 2 HEX CHAR, UPDATE CHECKSUM
08730 ED1A EB 00      PUNT2    ADD B    0,X      UPDATE CHECKSUM
08740          *
08750          *
08760 ED1C A6 00      PCH2H    LDA A    0,X      PUNCH 2 HEX CHARS
08770 ED1E 8D 05      BSR      PCHHL
08780 ED20 A6 00      LDA A    0,X
08790 ED22 08          INX
08800 ED23 20 04      BRA      PCHHR
08810          *
08820 ED25 44          PCHHL    LSR A      PUNCH HEX LEFT BCD DIGIT
08830 ED26 44          LSR A
08840 ED27 44          LSR A
08850 ED28 44          LSR A
08860          *
08870 ED29 84 0F      PCHHR    AND A    ##F      PUNCH HEX RIGHT BCD DIGIT
08880 ED2B 8B 30      ADD A    ##30
08890 ED2D 81 39      CMP A    ##39
08900 ED2F 23 02      BLS      *+4
08910 ED31 8B 07      ADD A    ##7
08920 ED33 7E EFB3     JMP      PPT
08930          ED36      MCLOFF EQU      *
08940 ED36 13          FCB      $13      READER RELAY OFF
08950 ED37 0D          MCL      FCB      $D,$A,$14,0,0,0,0,'>,4 C/R, L/F, PUNC
        ED38 0A
        ED39 14
        ED3A 00
        ED3B 00
        ED3C 00
        ED3D 00
        ED3E 3E
        ED3F 04
08960 ED40 0D          PS1      FCB      $D,$A,0,0,0,0,'S','1,4
        ED41 0A
        ED42 00
        ED43 00
        ED44 00
        ED45 00
        ED46 53
        ED47 31
        ED48 04
08970 ED49 0D          PS9      FCB      $D,$A,0,0,0,0,'S','9,4
        ED4A 0A
        ED4B 00
        ED4C 00
        ED4D 00

```

ED4E 00
ED4F 53
ED50 39
ED51 04

```

08990      * GET VALUE ROUTINES
09000      *
09010      * GET 16 BIT VALUE IN X, A REG = TERMINATING CHAR
09020      *
09030 ED52 7F E01E GV16   CLR      VAL
09040 ED55 7F E01F       CLR      VAL+1
09050 ED58 BD EF08 G2    JSR      INHEX
09060 ED5B 26 04        BNE      G1      NOT HEX
09070 ED5D 8D 4C        BSR      SHFT
09080 ED5F 20 F7        BRA      G2
09090 ED61 FE E01E G1    LDX      VAL
09100 ED64 17           TBA          TERMINATING CHAR
09110 ED65 39           RTS
09120      *
09130      * GET 8 BIT VALUE (B REG)
09140      * A = 0 IF CR AND NO VALUE
09150      * A = 1 IF I, 2 IF J, -1 OTHER
09160      * LEADING SPACES IGNORED, RXX IS REL VALUE
09170      *
09180 ED66 7F E02E GV8    CLR      RELMOD
09190 ED69 BD EF08 G15    JSR      INHEX
09200 ED6C 26 18        BNE      G10
09210 ED6E 8D 3B        BSR      SHFT
09220 ED70 BD EF08      JSR      INHEX
09230 ED73 26 29        BNE      GCE      2ND DIGIT NOT HEX
09240 ED75 8D 34        BSR      SHFT
09250 ED77 F6 E01F      LDA B     VAL+1
09260 ED7A B6 E02E      LDA A     RELMOD
09270 ED7D 27 04        BEQ      G16
09280 ED7F F0 E024      SUB B     ALTLOC+1
09290 ED82 5A          DEC B
09300 ED83 86 FF      G16    LDA A     ##FF
09310 ED85 39          RTS
09320      *
09330 ED86 C1 0D      G10    CMP B     ##D
09340 ED88 27 17        BEQ      G13      CR
09350 ED8A C1 20        CMP B     ##20
09360 ED8C 27 DB        BEQ      G15      SPACE
09370 ED8E C1 52        CMP B     #'R
09380 ED90 27 14        BEQ      G14      REL ADDR
09390 ED92 86 01        LDA A     #1
09400 ED94 C1 49        CMP B     #'I
09410 ED96 27 0B        BEQ      G13A
09420 ED98 86 02        LDA A     #2
09430 ED9A C1 4A        CMP B     #'J
09440 ED9C 27 05        BEQ      G13A
09460 ED9E 7E E962 GCE  JMP      COMERR
09470      *
09480 EDA1 86 00      G13    LDA A     #0      CR
09490 EDA3 81 00      G13A  CMP A     #0
09500 EDA5 39          RTS
09510      *
09520 EDA6 7C E02E G14    INC      RELMOD    R
09530 EDA9 20 BE        BRA      G15

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```

09540      *
09550      *
09560 EDAB 8D 0D      SHFT      BSR      G20
09570 EDAD 8D 0B      BSR      G20
09580 EDAF 8D 09      BSR      G20
09590 EDB1 8D 07      BSR      G20
09600 EDB3 BB E01F      ADD A      VAL+1
09610 EDB6 B7 E01F      STA A      VAL+1
09620 EDB9 39          RTS
09630      *
09640 EDBA 78 E01E G20      ASL      VAL
09650 EDBD 78 E01F      ASL      VAL+1
09660 EDC0 24 03          BCC      G21
09670 EDC2 7C E01E          INC      VAL
09680 EDC5 39          G21      RTS

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```

09700          * VDM ROUTINES
09710          *
09720          * CLEAR VD SCREEN
09730          *
09740          EDC6      VDCLR EQU      *
09750 EDC6 FE E012      LDX      AVDBUF  CLEAR SCREEN
09760 EDC9 86 10        LDA A      #16
09770 EDCB C6 50        VD1      LDA B      #80
09780 EDCD 6F 00        VD2      CLR        0,X
09790 EDCF 08          INX
09800 EDD0 5A          DEC B
09810 EDD1 26 FA        BNE      VD2
09820 EDD3 4A          DEC A
09830 EDD4 26 F5        BNE      VD1
09840 EDD6 20 02        BRA      VD4
09850          *
09860          * SET CURSOR HOME
09870          *
09880 EDD8 8D 79        VDHOM BSR      VDRCC
09890 EDDA 7F E010      VD4      CLR      VDCUR  SET CURSOR HOME
09900 EDDD 7F E011      CLR      VDCUR+1
09910 EDE0 20 68        BRA      VDSCC
09920          *
09930          * VD STORE AND INCREMENT CURSOR
09940          *
09950 EDE2 8D 50        VDSTC BSR      GCA      GET CURSOR ADDRESS
09960 EDE4 85 60        BIT A      #60
09970 EDE6 27 61        BEQ      VDRTS      0-1F
09980 EDE8 A7 00        STA A      0,X
09990          *
10000          * INCREMENT CURSOR
10010          *
10020 EDEA 8D 67        VDINC BSR      VDRCC  RESET CURSOR CHAR
10030 EDEC FE E010      LDX      VDCUR
10040 EDEF 08          INX
10050 EDF0 FF E010      STX      VDCUR
10060          *
10070          * SCROLL IF SCREEN OVERFLOW (CONDITIONAL)
10080          *
10090          EDF3      VDCSCR EQU      *
10100 EDF3 F6 E010      LDA B      VDCUR
10110 EDF6 C1 05        CMP B      #5      500 HEX = 16*80 DECIMAL
10120 EDF8 2D 50        BLT      VDSCC
10130 EDFA 8D 02        SCR      BSR      VDUSCR
10140 EDFC 20 F5        BRA      VDCSCR
10150          *
10160          * UNCONDITIONAL SCROLL
10170          *
10180          EDFE      VDUSCR EQU      *
10190 EDFE 8D 53        BSR      VDRCC
10200 EE00 CE 04B0      LDX      #1200      15*80
10210 EE03 FF E038      STX      VDTMP
10220 EE06 F6 E039      LDA B      VDTMP+1
10230 EE09 FE E012      LDX      AVDBUF  MOVE ALL LINES UP

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```

10240 EE0C A6 50   VD40   LDA A   80,X
10250 EE0E A7 00           STA A   0,X
10260 EE10 08           INX
10270 EE11 5A           DEC B
10280 EE12 26 F8           BNE     VD40
10290 EE14 7A E038        DEC     VDTMP
10300 EE17 2A F3           BPL     VD40
10310 EE19 C6 50           LDA B   #80      BLANK LAST LINE
10320 EE1B 6F 00   VD41   CLR     0,X
10330 EE1D 08           INX
10340 EE1E 5A           DEC B
10350 EE1F 26 FA           BNE     VD41
10360 EE21 B6 E011        LDA A   VDCUR+1  DECREMENT CURSOR BY 80
10370 EE24 80 50           SUB A   #80
10380 EE26 B7 E011        STA A   VDCUR+1
10390 EE29 24 07           BCC     VD42
10400 EE2B 7A E010        DEC     VDCUR
10410 EE2E 2A 02           BPL     VD42
10420 EE30 20 94           BRA     VDCLR
10430 EE32 20 16   VD42   BRA     VDSCC
10440           *
10450           * GET CURSOR ADDRESS (SAVE A)
10460           *
10470 EE34 F6 E013   GCA     LDA B   AVDBUF+1
10480 EE37 FB E011           ADD B   VDCUR+1
10490 EE3A F7 E039        STA B   VDTMP+1
10500 EE3D F6 E012        LDA B   AVDBUF
10510 EE40 F9 E010        ADC B   VDCUR
10520 EE43 F7 E038        STA B   VDTMP
10530 EE46 FE E038        LDX     VDTMP
10540 EE49 39           VDRTS   RTS
10550           *
10560           * SET CURSOR CHARACTER
10570           *
10580 EE4A 8D E8   VDSCC   BSR     GCA
10590 EE4C E6 00           LDA B   0,X
10600 EE4E CA 80           ORA B   #128
10610 EE50 E7 00   VD3     STA B   0,X
10620 EE52 39           RTS
10630           *
10640           * RESET CURSOR CHARACTER
10650           *
10660 EE53 8D DF   VDRCC   BSR     GCA
10670 EE55 E6 00           LDA B   0,X
10680 EE57 C4 7F           AND B   #7F
10690 EE59 20 F5           BRA     VD3
10700           *
10710           * CR AND LF
10720           *
10730 EE5B 8D 11   VDCRLF   BSR     VDCR
10740           *
10750           * LINE FEED
10760           *
10770 EE5D 8D F4   VDLF     BSR     VDRCC

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10780 EE5F 86 50          LDA A  #80
10790 EE61 BB E011        ADD A  VDCUR+1
10800 EE64 B7 E011        STA A  VDCUR+1
10810 EE67 24 03          BCC    VD5
10820 EE69 7C E010        INC    VDCUR
10830 EE6C 20 85          VD5    BRA    VDCSCR
10840                      *
10850                      * CARRAGE RETURN
10860                      *
10870 EE6E 8D E3          VDCR    BSR    VDRCC
10880 EE70 4F              CLR A
10890 EE71 5F              CLR B
10900 EE72 B1 E010 VD13    CMP A  VDCUR
10910 EE75 2D 09          BLT    VD10
10920 EE77 2E 0D          BGT    VD11
10930 EE79 F1 E011        CMP B  VDCUR+1
10940 EE7C 27 0C          BEQ    VD12
10950 EE7E 22 06          BHI    VD11
10960 EE80 CB 50          VD10    ADD B  #80
10970 EE82 89 00          ADC A  #0
10980 EE84 20 EC          BRA    VD13
10990 EE86 C0 50          VD11    SUB B  #80
11000 EE88 82 00          SBC A  #0
11010 EE8A B7 E010 VD12    STA A  VDCUR
11020 EE8D F7 E011        STA B  VDCUR+1
11030 EE90 20 B8          BRA    VDSCC
11040                      *
11050                      * VD BACKSPACE
11060                      *
11070 EE92 8D BF          VD5S    BSR    VDRCC
11080 EE94 FE E010        LDX    VDCUR
11090 EE97 27 B0          BEQ    VDRTS
11100 EE99 09              DEX
11110 EE9A FF E010        STX    VDCUR
11120 EE9D 20 AB          BRA    VDSCC
11130                      *
11140                      * VD OUTPUT A CHARACTER
11150                      *
11160 EE9F FF E05C VDOUT    STX    XTEMP
11170 EEA2 37              PSH B
11180 EEA3 8D 44          BSR    CVUC
11190 EEA5 20 13          BRA    IINCEP
11200                      *
11210                      * VD INPUT CHARACTER
11220                      *
11230                      EEA7    VDINPU EQU    *
11240 EEA7 FF E05C        STX    XTEMP
11250 EEA8 37              PSH B
11260                      * READ CHARACTERS
11270 EEAB B6 FD13 VD53    LDA A  PIAVD+3
11280 EEAE 2A FB          BPL    VD53
11290 EEB0 B6 FD12        LDA A  PIAVD+2
11300                      *
11310 EEB3 8D 34          BSR    CVUC

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11320 EEB5 FE E016      LDX      AII
11330 EEB8 6E 00      JMP      0,X
11340      EEBA      IINCEP EQU      *
11350 EEB8 CE EED9      LDX      #VDTBL
11360 EEBD E1 00      VD50      CMP      B      0,X
11370 EEBF 27 09      BEQ      VDEQ
11380 EEC1 6D 00      TST      0,X
11390 EEC3 2B 09      BMI      VD52
11400 EEC5 08      INX
11410 EEC6 08      INX
11420 EEC7 08      INX
11430 EEC8 20 F3      BRA      VD50
11440 EECA EE 01      VDEQ      LDX      1,X
11450 EECB AD 00      JSR      0,X
11460 EECE B6 E01D      VD52      LDA      A      CHARUC
11470 EED1 BD EDE2      JSR      VDSTC
11480 EED4 FE E05C      LDX      XTEMP
11490 EED7 33      PUL      B
11500 EED8 39      RTS
11510      *
11520 EED9 0D      VDTBL      FCB      $D
11530 EEDA EE6E      FDB      VDCR
11540 EEDC 0A      FCB      $A
11550 EEDD EE5D      FDB      VDLF
11560 EEDF 08      FCB      8
11570 EEE0 EE92      FDB      VD8S
11580 EEE2 0E      FCB      $E      CONTROL N
11590 EEE3 EDD8      FDB      VDHOM
11600 EEE5 0C      FCB      $C      CONTROL L
11610 EEE6 EDC6      FDB      VDCLR
11620 EEE8 FF      FCB      $FF      TABLE END
11630      *
11640      * CONVERT A TO UPPERCASE IN B WITHOUT PARITY
11650      *
11660 EEE9 16      CVUC      TAB
11670 EEEA B7 E01C      STA      A      CHAR
11680 EEED C4 7F      AND      B      #$7F
11690 EEEF C1 61      CMP      B      #$61
11700 EEF1 2D 06      BLT      VD200
11710 EEF3 C1 7B      CMP      B      #$7B
11720 EEF5 2C 02      BGE      VD200
11730 EEF7 C0 20      SUB      B      #$20
11740 EEF9 F7 E01D      VD200      STA      B      CHARUC
11750 EEFC 39      RTS

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11770          * MONITOR ROUTINES
11780          E400      PIAD      EQU      PIASIO
11790          E401      PIAS      EQU      PIASIO+1
11800          E402      PIADB     EQU      PIASIO+2
11810          E403      PIASB     EQU      PIASIO+3
11820          * PRINT DATA POINTED AT BY X-REG
11830 EF0D BD E9A0 PDATA2 JSR      OUTCH
11840 EF00 08              INX
11850 EF01 A6 00      PDATA1 LDA A  0,X
11860 EF03 81 04              CMP A  #4
11870 EF05 26 F6              BNE      PDATA2
11880 EF07 39              RTS          STOP ON EOT
11890          * INPUT HEX CHAR
11900 EF08 BD E9A3 INHEX JSR      INCH
11910          EF0B      CVAX      EQU      *          CONVERT ASCII TO HEX
11920 EF0B 16              TAB
11930 EF0C 80 30              SUB A  #$30
11940 EF0E 2B 10              BMI      CVAX1          NOT HEX
11950 EF10 81 09              CMP A  #$09
11960 EF12 2F 0A              BLE      CVAX2
11970 EF14 81 11              CMP A  #$11
11980 EF16 2B 08              BMI      CVAX1          NOT HEX
11990 EF18 81 16              CMP A  #$16
12000 EF1A 2E 04              BGT      CVAX1          NOT HEX
12010 EF1C 80 07              SUB A  #7
12020 EF1E C6 00      CVAX2 LDA B  #0
12030 EF20 C1 00      CVAX1 CMP B  #0
12040 EF22 39              IN1HG RTS
12050          EF23      OUT2H     EQU      *
12060 EF23 A6 00              LDA A  0,X
12070 EF25 BD E992 OUT2HA JSR      OUTHL          OUT LEFT HEX CHAR
12080 EF28 A6 00              LDA A  0,X
12090 EF2A 08              INX
12100 EF2B 7E E996              JMP      OUTHR          OUTPUT RIGHT HEX CHAR
12110 EF2E 8D F3      OUT4HS BSR      OUT2H          OUTPUT 4 HEX CHAR + SPACE
12120 EF30 8D F1      OUT2HS BSR      OUT2H          OUTPUT 2 HEX CHAR + SPACE
12130 EF32 86 20      OUTS      LDA A  #$20          SPACE
12140 EF34 7E E9A0              JMP      OUTCH
12150          * ENTER FROM SOFTWARE INTERRUPT
12170          EF37      SFTINT     EQU      *
12180 EF37 BF E049              STS      SP          SAVE TARGET'S STACK POINTER
12190          * DECREMENT P-COUNTER
12200 EF3A 30              TSX
12210 EF3B 6D 06              TST      6,X
12220 EF3D 26 02              BNE      *+4
12230 EF3F 6A 05              DEC      5,X
12240 EF41 6A 06              DEC      6,X
12250 EF43 BD EA13              JSR      CRLF
12260 EF46 CE EFEC              LDX      #MBRK
12270 EF49 8D B6              BSR      PDATA1
12280          * PRINT CONTENTS OF STACK
12290 EF4B BD EA13 PRINT JSR      CRLF
12300 EF4E FE E049              LDX      SP
12310 EF51 08              INX

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12320	EF52	8D	DC		BSR	OUT2HS	CONDITION CODES
12330	EF54	8D	DA		BSR	OUT2HS	ACC-B
12340	EF56	8D	D8		BSR	OUT2HS	ACC-A
12350	EF58	8D	D4		BSR	OUT4HS	X-REG
12360	EF5A	8D	D2		BSR	OUT4HS	P-COUNTER
12370	EF5C	CE	E049		LDX	#SP	
12380	EF5F	8D	CD		BSR	OUT4HS	STACK POINTER
12390	EF61	7E	E8A2	C2	JMP	CONTRL	
12400				*			
12410	EF64	FF	E05C	SAV	STX	XTEMP	
12420	EF67	CE	E400		LDX	#PIAD	
12430	EF6A	39			RTS		
12400				*			
12410				*			* INPUT ONE CHAR INTO A-REGISTER
12460				*			
12470	EF6B	7D	E012	INEEE	TST	AVDBUF	
12480	EF6E	27	03		BEQ	MON1	
12490	EF70	7E	EEA7		JMP	VDINPUT	
12500	EF73			RPT	EQU	*	
12510	EF73	37		MON1	PSH B		
12520	EF74	8D	EE		BSR	SAV	SAVE X-REG
12530	EF76	A6	00	IN1	LDA A	0,X	LOOK FOR START BIT
12540	EF78	2B	FC		BMI	IN1	
12550	EF7A	6F	02		CLR	2,X	SET COUNTER FOR HALF BIT TIME
12560	EF7C	8D	57		BSR	DE	START TIMER
12570	EF7E	8D	51		BSR	DEL	DELAY HALF BIT TIME
12580	EF80	C6	04		LDA B	#4	SET DEL FOR FULL BIT TIME
12590	EF82	E7	02		STA B	2,X	
12600	EF84	58			ASL B		SET UP CNTR WITH 8
12610	EF85	8D	4A	IN3	BSR	DEL	WAIT ONE CHAR TIME
12620	EF87	0D			SEC		MARK COM LINE
12630	EF88	69	00		ROL	0,X	GET BIT INTO CFF
12640	EF8A	46			ROR A		
12650	EF8B	5A			DEC B		
12660	EF8C	26	F7		BNE	IN3	
12670	EF8E	8D	41		BSR	DEL	WAIT FOR STOP BIT
12680	EF90	84	7F		AND A	#7F	RESET PARITY BIT
12690	EF92	81	7F		CMP A	#7F	
12700	EF94	27	E0		BEQ	IN1	IF RUBOUT, GET NEXT CHAR
12710	EF96	BD	EEE9		JSR	CVUC	
12720	EF99	20	2A		BRA	IOUT2	GO RESTORE REG
12730				*			
12740				*			* OUTPUT ONE CHAR
12750				*			
12760	EF9B	7D	E400	OUTEEE	TST	PIAD	
12770	EF9E	2A	C1		BPL	C2	TTY INTERRUPT
12780	EFA0	FF	E05C		STX	XTEMP	
12790	EFA3	FE	E01A		LDX	AOI	OUTPUT INTERRUPT
12800	EFA6	6E	00		JMP	0,X	
12810	EFA8	FE	E05C	OINCPT	LDX	XTEMP	
12820	EFAB	7D	E012		TST	AVDBUF	
12830	EFAE	27	03		BEQ	MON2	
12840	EFB0	7E	EE9F		JMP	VDOUT	
12850	EFB3			PPT	EQU	*	

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12860 EFB3 37      MON2  PSH B
12870 EFB4 8D AE      BSR     SAV      SAVE X-REG
12880 EFB6 C6 0A      IOUT  LDA B  ##A    SET UP COUNTER
12890 EFB8 6A 00      DEC     0,X      SET START BIT
12900 EFBA 8D 19      BSR     DE        START TIMER
12910
12920 EFBC 8D 13      OUT1  BSR     DEL      DELAY ONE BIT TIME
12930 EFBE A7 00      STA A  0,X      PUT OUT ONE DATA BIT
12940 EFC0 0D          SEC              SET CARRY BIT
12950 EFC1 46          ROR A              SHIFT IN NEXT BIT
12960 EFC2 5A          DEC B              DECREMENT COUNTER
12970 EFC3 26 F7      BNE     OUT1      TEST FOR 0
12980 EFC5 E6 02      IOUT2 LDA B  2,X    TEST FOR STOP BITS
12990 EFC7 58          ASL B              SHIFT BIT TO SIGN
13000 EFC8 2A 02      BPL     IOS        BRANCH FOR 1 STOP BIT
13010 EFCA 8D 05      BSR     DEL        DELAY FOR STOP BITS
13020 EFCC FE E05C    IOS  LDX     XTEMP   RETORE X-REG
13030 EFCF 33      MON205 PUL B          RESTORE B-REG
13040 EFD0 39          RTS
13050
13060 EFD1 6D 02      DEL     TST     2,X    IS TIME UP
13070 EFD3 2A FC      BPL     DEL
13080 EFD5 6C 02      DE      INC     2,X    RESET TIMER
13090 EFD7 6A 02      DEC     2,X
13100 EFD9 39          RTS
13110
13120      * READ PT HEX
13130      *
13140 EFDA 8D 97      RPTHEX BSR     RPT
13150 EFDC 37          PSH B
13160 EFDD BD EFOB      JSR     CVAX      CONVERT ASCII TO HEX
13170 EFE0 27 ED      BEQ     MON205
13180 EFE2 7E E962    MONCE JMP     COMERR
13190 EFE5 50      MPWON  FCC     /PWR ON/
13200 EFEB 04          FCB     4
13210 EFEC 42      MBRK   FCC     /BRK/
13220 EFED 52
13230 EFEE 4B
13240 EFEE 04          FCB     4
13250
13260 EFF8          ORG     ROMORG+$7F8
13270 EFF8 E800      FDB     INTINT
13280 EFFA E805      FDB     INTSFT
13290 EFFC E80A      FDB     INTNM
13300 EFFE E80F      FDB     START
13400
ROMORG E800

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RAMORG E000
PIAVD FD10
PIASID E400
AMINT E000
ASINT E002
ANMINT E004
VDCUR E010
AVDBUF E012
ATOPM E014
AII E016
ADI E018
AOI E01A
CHAR E01C
CHARUC E01D
VAL E01E
TYPLOC E020
TYPCNT E022
ALTLOC E023
INBLK E025
INLOC E027
BRKPTR E029
BRKSAV E02B
COLCNT E02D
RELMOD E02E
INST0 E02F
INST1 E030
INST2 E031
INSIZE E035
TEMP99 E036
VDTMP E038
DFLTCC E03A
XSUMV E03B
XSUMB E03D
XSUME E03F
IOV E041
BEGA E043
ENDA E045
NIO E047
SP E049
CKSM E04B
BYTECT E04C
XHI E04D
XLOW E04E
TEMP E04F
TW E050
MCONT E052
XTEMP1 E053
SLMODE E055
ZLOC1 E056
ZLOC2 E058
ZVAL E05A
XTEMP E05C
FWRTST E05E
FWREND E068

STACK	E0B8
STKUF	E0C0
BRKTBL	E0C2
INTINT	E800
INTSFT	E805
INTNM	E80A
START	E80F
RSTINT	E80F
MC3	E82C
MC2	E83C
MC1	E847
ININ	E85A
MCNOVD	E891
CONTRL	E8A2
PORNC	E8C1
DINCPT	E8CE
PONXT	E8D1
POCE	E8DE
POEQ	E8E1
POTBL	E8E5
POSL	E916
LOAD	E91B
PT1	E927
LOAD3	E933
LOAD11	E951
LOAD15	E95D
COMERR	E962
LOAD19	E962
LOAD21	E96D
C1	E96D
BADDR	E970
BYTE	E97E
OUTHL	E992
OUTHR	E996
OUTCH	E9A0
INCH	E9A3
TYPCOM	E9B3
TC1	E9D4
TC2	E9E5
TC6	E9F2
TC5	E9F4
TC3	E9FE
TC4	EA01
TCCE	EA10
CRLF	EA13
TMCRLF	EA20
SPCBAR	EA27
SETCC	EA2F
C3	EA38
TCC	EA38
ALTCOM	EA3B
AC1	EA45
ACC	EA38
AC2	EA5D

CE10	EA81
AC3	EA84
GOCOM	EA90
GO1	EA99
WCOM	EAA0
I3	EAB0
INSERT	EAB6
I2	EAC4
I1	EADC
I	EAFF
ICE	EB14
J	EB17
ADDAX	EB34
I15	EB3F
GRPINS	EB46
I10	EB70
SIZTEL	EB74
ICPX	EB84
ILDX	EB84
IBRA	EB88
IBSR	EB88
B1	EB8B
BRKQ	EB8E
B2	EB94
BRKSET	EBA7
B3	EBA7
BRKRST	EBB4
B4	EBB4
B7	EBC6
BRKNXT	EBD1
B5	EBD1
B6	EBE1
SBP	EBEC
B11	EC12
RBP	EC13
B13	EC19
B12	EC2F
B10	EC53
CE2	EC53
BCE	EC53
HOLD	EC56
IO	EC9A
GETCR	EC9C
PCE	EC53
PUNCH	ECA4
P1	ECB7
PUN11	ECCA
PUN22	ECDC
PUN23	ECDE
PUN32	ECFE
PCTRL	ED17
PUNT2	ED1A
PCH2H	ED1C
PCHHL	ED25

PCHHR	ED29
MCLOFF	ED36
MCL	ED37
PS1	ED40
PS9	ED49
GV16	ED52
G2	ED58
G1	ED61
GV8	ED66
G15	ED69
G16	ED83
G10	ED86
GCE	ED9E
G13	EDA1
G13A	EDA3
G14	EDA6
SHFT	EDAB
G20	EDBA
G21	EDC5
VDCLR	EDC6
VD1	EDCB
VD2	EDCD
VDHOME	EDD8
VD4	EDDA
VDSTC	EDE2
VDINC	EDEA
VDCSCR	EDF3
SCR	EDFA
VDUSCR	EDFE
VD40	EE0C
VD41	EE1B
VD42	EE32
GCA	EE34
VDRTS	EE49
VDSCC	EE4A
VD3	EE50
VDRCC	EE53
VDCRLF	EE5B
VDLF	EE5D
VD5	EE6C
VDCR	EE6E
VD13	EE72
VD10	EE80
VD11	EE86
VD12	EE8A
VDBS	EE92
VDOUT	EE9F
VDINPU	EEA7
VD53	EEAB
IINCEP	EEBA
VD50	EEBD
VDEQ	EECA
VD52	EECE
VDTBL	EED9

CVUC EEE9
 VD200 EEF9
 PIAD E400
 PIAS E401
 PIADB E402
 PIASB E403
 PDATA2 EEFD
 PDATA1 EF01
 INHEX EF08
 CVAX EF0B
 CVAX2 EF1E
 CVAX1 EF20
 IN1HG EF22
 OUT2H EF23
 OUT2HA EF25
 OUT4HS EF2E
 OUT2HS EF30
 OUTS EF32
 SFTINT EF37
 PRINT EF4B
 C2 EF61
 SAV EF64
 INEEE EF6B
 RPT EF73
 MON1 EF73
 IN1 EF76
 IN3 EF85
 OUTEEE EF9B
 OINCPT EFA8
 PPT EFB3
 MON2 EFB3
 IOUT EFB6
 OUT1 EFB6
 IOUT2 EFC5
 IOS EFCC
 MON205 EFCF
 DEL EFD1
 DE EFD5
 RPTHEX EFDA
 MONCE EFE2
 MPWON EFE5
 MBRK EFEC

TOTAL ERRORS 00000

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